DECLARATION

I, Kiyoko Kono declare that:

1. I reside at c/o Saikyo Patent Office, Shikishima Building 6th Floor, 2-6, Bingomachi 3-chome, Chuo-ku, Osaka, Japan.

2. I understand and read both the Japanese and the English languages.

3. The attached is a full true and faithful English translation made by me of the priority document of the Japanese Patent Application No. 10-273245, filed on September 28, 1998.

4. I declare further that all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the above-identified application or any patent issuing thereon.

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PATENT OFFICE
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Date of Application	:	September 28, 1998
Application Number	:	Japanese Patent Application No. 10-273245
Applicant	:	SHARP KABUSHIKI KAISHA

June 28, 1999

Commissioner, Patent Office — Takeshi ISAYAMA

(seal)

Certificate Issue Number 11-3045497

[DOCUMENT] APPLICATION FOR PATENT

[REFERENCE] 98-02577

[FILING DATE] September 28, 1998

[ADDRESSEE] To Commissioner of the Patent Office

[IPC] G02F 1/1343

[TITLE OF THE INVENTION] METHOD OF MANUFACTURING REFLECTIVE-TYPE LIQUID CRYSTAL DISPLAY APPARATUS

[NUMBER OF CLAIMS] 4

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[IDENTIFICATION OF OFFICIAL FEE]

[Prepaid No.]	012313
[Official Fee]	¥21,000

[LIST OF THE ATTACHED DOCUMENTS]

[Item]	Specification	1
[Item]	Drawing(s)	1
[Item]	Abstract	1

[General Power of Attorney No.] 9703283

[PROOF REQUEST] Yes

[DOCUMENT] SPECIFICATION

[TITLE OF THE INVENTION] METHOD OF MANUFACTURING REFLECTIVE-TYPE LIQUID CRYSTAL DISPLAY APPARATUS

[CLAIMS]

[Claim 1] A method of manufacturing a reflective-type liquid crystal display apparatus having, on a pair of substrates disposed so as to be opposed with a liquid crystal layer therebetween, reflecting means for reflecting incident light from the other substrate, comprising the steps of:

applying a negative photosensitive resin on one of the substrates disposed on the side of the liquid crystal layer;

exposing the negative photosensitive resin uniform and low illuminance using a first photomask;

exposing the negative photosensitive resin uniform and high illuminance using a second photomask;

developing the exposed photosensitive resin using developer solution;

heat-treating the developed photosensitive resin; and

forming a reflecting electrode on the heat-treated photosensitive resin.

[Claim 2] The method of manufacturing a reflective-type liquid crystal display apparatus of claim 1, wherein the reflecting electrode is connected to a liquid crystal driving

device, and the transmitting region of the first photomask corresponds to the entire region other than the contact hole for connecting the reflecting electrode with the liquid crystal driving device.

[Claim 3] The method of manufacturing a reflective-type liquid crystal display apparatus of claim 1, wherein circular or polygonal transmitting regions are irregularly disposed in the second photomask and that the total area of the circular or polygonal transmitting regions is in a range of from 20% to 40% of the total area of the photomask.

[Claim 4] The method of manufacturing a reflective-type liquid crystal display apparatus of claim 3, wherein the circular or polygonal transmitting regions disposed in the second photomask are irregularly disposed so that the center-to-center distances between adjoining transmitting regions are in a range of from 5 μm to 50 μm.

[DETAILED DESCRIPTION OF THE INVENTION]

[0001]

[Technical field to which the invention belongs]

The present invention relates to a method of manufacturing a reflective-type liquid crystal display apparatus which carries out display by reflecting externally incident light.

[0002]

[Prior art]

In recent years, application of liquid crystal display apparatuses to word processors, laptop personal computers, pocket televisions and the like has rapidly been progressing. Of the liquid crystal display apparatuses, reflective-type liquid crystal display apparatuses which carry out display by reflecting externally incident light are attracting attention because the reflective-type liquid crystal display apparatuses are low in power consumption, thin and capable of being reduced in weight since no backlight is necessary.

[0003]

However, in the conventional reflective-type liquid crystal display apparatuses, the brightness and the contrast ratio of the display are dependent on the use environment such as ambient brightness or the use condition. Therefore, at present, high expectations are placed on the realization of a reflective-type liquid crystal display apparatus that has excellent reflection characteristics, can easily be manufactured with excellent reproducibility and is high in display quality.

[0004]

Japanese Unexamined Patent Publication JP-A 6-75238 discloses a technology to form random and high-density asperities on a reflecting electrode in order to improve the display quality of the reflective-type liquid crystal display

apparatus.

[0005]

According to this, a resin layer for adding fine asperities to a reflecting electrode comprises a first photosensitive resin layer patterned with random asperities and a second photosensitive resin layer for making the asperities smoother, and in a mask for patterning the first photosensitive resin layer, circular light intercepting portions are randomly disposed and the total area of the light intercepting portions is not less than 40% of the area of the reflecting plate.

[0006]

By increasing the randomness as described above, the interference due to the repetitive pattern is prevented and the reflecting light is prevented from being colored, and by increasing the density of the asperities, the area of the flat part is reduced to thereby reduce the regular reflection component.

[0007]

Moreover, Japanese Unexamined Patent Publication JP-A 9-90426 discloses a technology to simultaneously expose an asperity forming pattern and contact holes using only one layer of a positive photosensitive resin in order to reduce the process of manufacturing a reflective-type liquid crystal display apparatus.

[0008]

A method of manufacturing a reflective-type liquid crystal display apparatus described in this patent publication will briefly be described with reference to the drawings.

[0009]

Fig. 5 is a cross-sectional view showing the structure of a reflective-type liquid crystal display apparatus formed by the manufacturing method described in the above-mentioned patent publication. Fig. 6 shows cross-sectional views showing the flow of the manufacturing process.

[0010]

As shown in Fig. 5, in the reflective-type liquid crystal display apparatus described in the above-mentioned patent publication, a TFT substrate is used as a reflecting substrate 23, and the following are provided: an aluminum pixel electrode 10 disposed on the reflecting substrate 23; a transparent electrode 12 opposed thereto; a color filter substrate 25 supporting the transparent electrode 12; liquid crystal 11 sandwiched therebetween; a retardation film 15 disposed above the color filter substrate (on the side of the surface not opposed to the liquid crystal); and a polarizer 16 disposed above the retardation film 15.

[0011]

In the reflecting substrate 23, an amorphous silicon transistor is formed on a glass substrate 1 as the liquid crystal driving device 24. As shown in Fig. 5, the liquid crystal

driving device 24 comprises Ta as a gate electrode 2 on the glass substrate 1, SiNx as a insulating layer 3, a-Si as a semiconductor layer 4, n-type a-Si as an n-type semiconductor layer 5, Ti as a source electrode 7, and Ti as a drain electrode 8.

[0012]

A method of manufacturing the reflecting substrate 23 of the reflective-type liquid crystal display apparatus described in the above-mentioned patent publication will be described with reference to Fig. 6.

[0013]

First, as shown in Fig. 6(a), a positive photosensitive resin 9 is applied to the substrate 1.

[0014]

Then, as shown in Fig. 6(b), exposure is carried out at high illuminance using a photomask having transmitting portions corresponding to the contact hole and, in addition thereto, transmitting portions as shown in Fig. 7.

[0015]

Then, as shown in Fig. 6(c), by development with a developing solution, the resin in the exposed parts mentioned above is completely removed, so that a resin configuration that is positive with respect to the mask pattern is formed.

[0016]

Then, as shown in Fig. 6(d), by a heat treatment, the

resin in the exposed regions is deformed into smooth asperities. However, at this time the exposed regions are flat because the resin has completely been removed by the above-described developing step.

[0017]

Then, as shown in Fig. 6(e), an Al thin film is formed as the reflecting electrode 10, and patterning is performed so that one reflecting electrode 10 corresponds to one transistor.

[0018]

The reflecting electrode 10 of the reflective-type liquid crystal display apparatus described in the above-mentioned patent publication is formed by the above-described process. In such a reflecting substrate 23, since the positive photosensitive resin in the exposed portions has been completely removed, the area of the flat part is large. In such a reflecting plate in which the area of the flat part is large, since the light source is reflected in the flat region, the regular reflection component is large. Since display is difficult to confirm when the light source is reflected, the regular reflection component generally is avoided in the case of the reflective-type display apparatus.

[0019]

Therefore, the regular reflection component of the reflecting plate in the reflective-type liquid crystal display apparatus disclosed in the above-mentioned patent publication

do not contribute to the brightness, which results in dark display.

[0020]

[Problems that the invention is to solve]

Compared to the reflective-type liquid crystal display apparatus disclosed in JP-A 9-90426, previously-mentioned JP-A 6-75238 discloses a reflective-type liquid crystal display apparatus adopting a complicated asperity forming process in order to create an ideal scattering condition by improving the density of the asperities of the reflecting plate. According to this apparatus, after application of a first positive photosensitive resin, first exposure development of a sufficient intensity is performed. Then, after the patterning of the asperities are completely performed, the clearances of the asperities are completely filled so that the asperities are smooth. Then, a second positive photosensitive resin is applied in order to reduce the area of the flat part, and thereafter, only the patterning of the contact hole portions is again performed by performing second exposure development.

[0021]

However, in this process, since the photosensitive resin is applied in two layers, it is necessary to perform the photoprocess (application - exposure - development - heat treatment) of the photosensitive resin twice, so that the cost clearly increases.

[0022]

Further, in the reflective-type liquid crystal display apparatus disclosed in JP-A 9-90426, since one layer of a positive photosensitive resin is used, it is necessary to perform the photoprocess of the photosensitive resin only once, so that the process is simplified and cost reduction can be achieved. However, since it is necessary to remove certainly of the photosensitive resin in the contact hole portions, it is inevitable that the positive photosensitive resin in the exposed area in the asperity forming pattern portion is also removed. Consequently, the exposed area is flat, so that in the reflecting plate, the density of the asperities is low and the regular reflection component is large.

[0023]

The invention is made to solve the above-mentioned problems of the reflective-type liquid crystal display apparatus, and an object thereof is to provide a method of manufacturing a liquid crystal display apparatus with which a reflecting plate having excellent reflection characteristics can easily be manufactured with excellent reproducibility, whereby the display quality is improved.

[0024]

[Means of solving the problems]

In order to achieve the above-mentioned object, the invention provides a method of manufacturing a reflective-type

liquid crystal display apparatus having, on a pair of substrates disposed so as to be opposed with a liquid crystal layer therebetween, reflecting means for reflecting incident light from the other substrate, comprising the steps of:

applying a negative photosensitive resin on one of the substrates disposed on the side of the liquid crystal layer;

exposing the negative photosensitive resin uniform and low illuminance using a first photomask;

exposing the negative photosensitive resin uniform and high illuminance using a second photomask;

developing the exposed photosensitive resin using developer solution;

heat-treating the developed photosensitive resin; and

forming a reflecting electrode on the heat-treated photosensitive resin.

[0025]

Further, it is preferable that the reflecting electrode is connected to a liquid crystal driving device, and the transmitting region of the first photomask corresponds to the entire region other than the contact hole for connecting the reflecting electrode with the liquid crystal driving device.

[0026]

Furthermore, it is also preferable that circular or polygonal transmitting regions are irregularly disposed in the second photomask and that the total area of the circular or

polygonal transmitting regions is in a range of from 20% to 40% of the total area of the photomask.

[0027]

Still more, it is also preferable that the circular or polygonal transmitting regions disposed in the second photomask are irregularly disposed so that the center-to-center distances between adjoining transmitting regions are in a range of from 5 μm to 50 μm.

[0028]

Now, descriptions over how the method of manufacturing a liquid crystal display apparatus of the invention works are given below.

[0029]

According to the invention, by exposing one layer of a photosensitive resin applied to the substrate with the exposure of both of a low-illuminance and a high-illuminance on an area basis, smooth and high-density asperities can be formed, so that ideal reflecting means with a reduced flat area and a small regular reflection component can be formed. Consequently, the number of photoprocesses of the photosensitive resin can be reduced to thereby reduce the cost necessary for the manufacture.

[0030]

At the conventional exposing step, since the negative photosensitive resin in the part intercepted from light by a

photomask (light intercepted region) is readily soluble in a developing solution, and since the negative photosensitive resin in the part not intercepted from light by the photomask (transmitting region) is not readily soluble in the developing solution, a photosensitive resin film having asperities is formed on the substrate in correspondence with the transmitting region and the light intercepted region of the photomask by developing the photosensitive resin with the developing solution after the exposure.

[0031]

In the invention, exposure at the steps of exposing the negative photosensitive resin is performed with both high and low illuminance. Here, the high-illuminance exposure indicates an exposure of such an extent of exposure amount that cross-linking of the resin sufficiently progresses in the negative photosensitive resin and the left film amount after the development is substantially equal to or larger than 50% of the film thickness before the development, and the low-illuminance exposure indicates an exposure of such an extent of exposure amount that cross-linking of the resin does not sufficiently progress in the negative photosensitive resin and the left film amount after the development is 0% or more and less than 50% of the film thickness before the development.

[0032]

More specifically, with the use of the method of

manufacturing the reflective-type liquid crystal according to claim 1, in the negative photosensitive resin formed on the substrate, owing to the low-illuminance exposure with the first photomask, cross-linking of the photosensitive resin in the part subjected to the low-illuminance exposure with the first photomask does not sufficiently progress, so that the film of the photosensitive resin in the part subjected to the low-illuminance exposure is uniformly reduced in thickness by the development with a development solution after the exposure.

[0033]

Moreover, in the negative photosensitive resin formed on the substrate, by performing the high-illuminance exposure using the second photomask, cross-linking of the photosensitive resin in the part exposed at a high illuminance using the second photomask sufficiently progresses, so that a convex portion being higher by one step than the unexposed part by the second photomask is formed by the development with the developing solution after the exposure and it is possible to form smooth asperities by the resin being deformed in a succeeding heat treatment.

[0034]

As described above, by performing the high-illuminance exposure, the low-illuminance exposure and development on one layer of negative photosensitive resin and then, heat-treating the photosensitive resin, the asperities of the photosensitive

resin formed on the substrate are deformed, so that continuous, high-density and smooth asperities without any flat part are formed on the substrate.

[0035]

Further, by forming the reflecting electrode on the heat-treated photosensitive resin having the smooth asperities, excellent reflecting means with a small regular reflection component can be formed.

[0036]

In the invention, the order of the steps of the low-illuminance exposure and the high-illuminance exposure may be opposite to the above-described order.

[0037]

As the process from the exposing step to the developing step, the following two are considered: the process from exposure (the low-illuminance exposure and the high-illuminance exposure) to development; and the process from exposure (the low-illuminance exposure or the high-illuminance exposure) through development and exposure (the high-illuminance exposure or the low-illuminance exposure) to development. In the invention, either of the two processes can be used. However, the former process is preferable in view of the simplification of the process.

[0038]

Further, with the use of the method of manufacturing the

reflective-type liquid crystal according to claim 2, since the transmitting region of the first photomask corresponds to the region other than the contact hole for connecting the reflecting electrode with the liquid crystal driving device, the contact hole portion is completely intercepted from light, being prevented from exposure. Therefore, the photosensitive resin at the contact hole portion is to be completely removed by the development process. Owing to that, the connection between the reflecting electrode and the TFT drein electrode can be formed securely and easily, so that asperities in which the area of the flat part is small and which is smooth over the entire picture element region can be formed. As a result, a reduced regular reflection can be realized, thereby obtaining a brighter reflected light.

[0039]

Further, with the use of the method of manufacturing the reflective-type liquid crystal according to claim 3, since the circular or polygonal transmitting regions are irregularly disposed in the second photomask, the periodicity of the pattern of the asperities of the photosensitive resin formed on the substrate is eliminated, so that the light interference phenomenon can be prevented. As a result, white scattered light without any color can be obtained. Moreover, since the scattered light from the asperities does not biased in a specific direction, uniform scattered light can be obtained.

[0040]

Since the total area of the circular or polygonal transmitting regions in the second photomask is in a range of from 20% to 40% of the photomask, the angle of inclination of the asperities of the photosensitive resin formed on the substrate can be controlled so that the light can efficiently be used.

[0041]

Here, in the case where the total area of the transmitting regions in the second photomask is not less than 40%, when the transmitting regions are randomly disposed, adjoining transmitting regions (circular or polygonal regions) overlap each other into a large pattern, so that the pattern density decreases as a whole and the ratio of the area of the flat part increases. As a result, a reflecting plate with a large regular reflection component is formed. In the case where the total area of the transmitting regions in the second photomask is not more than 20%, when the transmitting regions are randomly disposed, the distances between adjoining transmitting regions (circular or polygonal regions) are too large, so that the distances between convex portions and convex portions or concave portions and concave portions of the configuration of the photosensitive resin formed by development are too large and flat parts are left between convex portions or concave portions when the resin is deformed by heating. As a result,

a reflecting plate with a large regular reflection component is formed. From these, in the invention, the total area of the transmitting regions in the second photomask is in a range of from 20% to 40% of the total area of the photomask.

[0042]

With the use of the method of manufacturing the reflective-type liquid crystal according to claim 4, by irregularly disposing the circular or polygonal transmitting regions disposed in the second photomask so that the center-to-center distances between adjoining transmitting regions are in a range of from 5 μm to 50 μm, a sufficient number of asperity patterns can be disposed for one picture element of the reflective-type liquid crystal display apparatus, so that scattered light can be obtained in which there is no difference in characteristics between picture elements.

[0043]

In the case where adjoining circular or polygonal transmitting regions are disposed so as not to overlap each other, patterns in which the center-to-center distance is not more than 5 μm are not resolved but become flat because of the limit of resolution of the exposure machine, so that a reflecting plate with a large regular reflection component is formed. Generally, in a liquid crystal display apparatus, since the size of one picture element is not more than approximately 100 μm × 300 μm, to dispose approximately ten or more convex portions for

one picture element in order to obtain uniform scattering property, it is necessary that the center-to-center distance is substantially not more than 50 μm. When the center-to-center distance is equal to or larger than 50 μm, since the distances between the transmitting regions are large, the ratio of the area of the flat part increases, so that a reflecting plate with a large regular reflection component is formed. From these, in the invention, the transmitting regions disposed in the second photomask are irregularly disposed so that the center-to-center distances between adjoining transmitting regions are in a range of from 5 μm to 50 μm.

[0044]

[Working examples]

Now referring to the drawings, a reflective-type liquid crystal display apparatus of an embodiment of the invention is described below. Fig. 1 is a cross-sectional view showing a reflective-type liquid crystal display apparatus according to an embodiment of the invention. Fig. 2 shows cross-sectional views showing the flow of the manufacturing process of the substrate.

[0045]

In this embodiment, the below-described explanation is made in account of the conventional reflective-type liquid crystal display apparatus disclosed in JP-A 9-90426. The reflective-type liquid crystal display apparatus of this

embodiment has the following general construction.

[0046]

As shown in Fig. 1, in the reflective-type liquid crystal display apparatus described in the above-mentioned patent publication, a TFT substrate is used as a reflecting substrate 23, and the following are provided: an aluminum pixel electrode 10 disposed on the reflecting substrate 23; a transparent electrode 12 opposed thereto; a color filter substrate 25 supporting the transparent electrode 12; liquid crystal 11 sandwiched therebetween; a retardation film 15 disposed above the color filter substrate (on the side of the surface not opposed to the liquid crystal); and a polarizer 16 disposed above the retardation film 15.

[0047]

In the reflecting substrate 23, an amorphous silicon transistor is formed on a glass substrate 1 as the liquid crystal driving device 24. As shown in Fig. 1, the liquid crystal driving device 24 comprises Ta as a gate electrode 2 on the glass substrate 1, SiNx as a insulating layer 3, a-Si as a semiconductor layer 4, n-type a-Si as an n-type semiconductor layer 5, Ti as a source electrode 7, and Ti as a drain electrode 8.

[0048]

A signal input terminal portion 27 for inputting signals to a gate bus line and a source bus line comprises a Ta portion

and an ITO portion, both of which are formed by patterning simultaneously with the gate bus line.

[0049]

A manufacturing process of the reflecting substrate 23 of the reflective-type liquid crystal display apparatus according to this embodiment will be described with reference to Fig. 2.

[0050]

First, as shown in Fig. 2(a), a negative photosensitive resin 9 (the name of the product: FE301N manufactured by Fuji Film Olin) is applied to the substrate 1 in a thickness of 1 to 5 μm. In this embodiment, the resin 9 was applied in a thickness of 3 μm.

[0051]

Then, by using a first photomask in which contact hole portions 18 were intercepted from light as shown in Fig. 3, the region other than the contact hole portions was uniformly exposed at a low illuminance as shown in Fig. 2(b). It is desirable that the exposure amount at this time is 20 mj to 100 mj. In this embodiment, exposure was performed with an exposure amount of 40 mj.

[0052]

Then, by using a second photomask in which the area of transmitting portions 17 was in a range of from 20% to 40% as shown in Fig. 4, a uniform high illuminance was exposed as shown

in Fig. 2(c). It is desirable that the exposure amount at this time is 160 mj to 500 mj. In this embodiment, exposure was performed with an exposure amount of 240 mj, using a second photomask in which the area of transmitting portions 17 was 30%. At this time, the circular or polygonal transmitting portions 17 of the second photomask were randomly disposed so that the center-to-center distances between adjoining circular or polygonal transmitting portions 17 were in a range of from 5 μm to 50 μm, preferably, 10 μm to 20 μm. At this time, the first and the second photomasks were structured so as to intercept the signal input terminal portion from light.

[0053]

Then, as shown in Fig. 2(d), by performing development with a developing solution TMAH (tetramethylammoniumhydrooxide) manufactured by Tokyo Ohka Kogyo Co., Ltd., the resin in the unexposed part (the contact hole portions and the terminal portion) was completely removed, approximately 40%, with respect to the initial film thickness, of the resin in the part exposed at a low illuminance was left, and approximately 80%, with respect to the initial film thickness, of the resin in the part exposed at a high illuminance was left.

[0054]

Then, as shown in Fig. 2(e), by performing a heat treatment at 200℃ for 60 minutes, the resin of the exposed

region was deformed into smooth asperities.

[0055]

Then, as shown in Fig. 2(f), an Al thin film was formed by sputtering as the reflecting electrode 10 in a thickness of 2000 Å, and as shown in Figs. 2(g) to (k), patterning was performed so that one reflecting electrode 10 corresponds to one transistor.

[0056]

Specifically, the photoresist 28 was applied as shown in Fig. 2(g), the terminal portion and a portion to be removed between pixel electrodes were exposed as shown in Fig. 2(h), and development, etching and exfoliation were performed as shown in Figs. 2(i) to (k) to thereby perform patterning of the Al electrode.

[0057]

In the embodiment according to the invention, by the above-described process, the reflecting plate having smooth and high-density asperities was formed. In such a reflecting plate 23, the area of the flat part is reduced, so that ideal reflecting plate having a small regular reflection component can be formed. Moreover, the number of photoprocesses of the photosensitive resin can be reduced, so that the cost necessary for the manufacture of the reflecting plate can be reduced.

[0058]

[Effect of the invention]

According to the invention, by exposing one layer of a photosensitive resin applied to the substrate with the exposure of both of a low-illuminance and a high-illuminance on an area basis, smooth and high-density asperities can be formed, so that ideal reflecting means with a reduced flat area and a small regular reflection component can be formed. Consequently, the number of photoprocesses of the photosensitive resin can be reduced to thereby reduce the cost necessary for the manufacture.

[0059]

In the invention, since a negative photosensitive resin is used, the resin in a part that is not exposed because of the presence of dust or the like can be removed by development, so that electric continuity is ensured even when dust or the like adheres to the contact hole portions and the terminal portion.

[BRIEF EXPLANATION OF THE DRAWINGS]

[Fig. 1]

Fig. 1 is a cross-sectional view of the reflective-type liquid crystal display apparatus formed by the method of manufacturing a reflective-type liquid crystal display apparatus according to an embodiment of the invention.

[Fig. 2]

Figs. 2(a) to (f) are cross-sectional views showing a manufacturing process of the reflecting substrate used in the

reflective-type liquid crystal display apparatus according to an embodiment of the invention.

[Fig. 3]

Fig. 3 is a schematic plan view showing the patterns of a transmitting region and light intercepting region of a first photomask according to an embodiment of the invention.

[Fig. 4]

Fig. 4 is a schematic plan view showing the patterns of transmitting region and a light intercepting region of a second photomask according to an embodiment of the invention.

[Fig. 5]

Fig. 5 is a cross-sectional view showing the reflective-type liquid crystal display apparatus formed by the conventional manufacturing method.

[Fig. 6]

Figs. 6(a) to (e) are cross-sectional views showing the manufacturing process of the reflecting substrate in the conventional reflective-type liquid crystal display apparatus.

[Fig. 7]

Fig. 7 is a schematic plan view showing the patterns of the transmitting regions and the light intercepting region of the conventional photomask.

[Reference numerals]

1 glass substrate on the TFT side

2 gate bus line (Ta)

3	gate insulating film (SiNx)
4	semiconductor layer (a-Si)
5	n-type semiconductor layer (n-type a-Si)
6	etch stopper
7	source electrode
8	drain electrode
9	insulating layer between layers (positive photosensitive resin)
10	reflecting electrode
11	liquid crystal layer
12	ITO electrode
13	color filter
14	glass plate on the side of color filter
15	retardation film
16	polarizer
17	transmitting portion
18	light intercepting portion
19	first photomask
20	second photomask
21	photomask
22	UV light
23	reflecting substrate
24	liquid crystal driving device
25	color filter substrate
26	terminal ITO electrode

27	signal input terminal portion
28	photoresist